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Introduction

The Idaho National Engineering and Environmental Laboratory (INEEL) is a DOE multi-program national laboratory that conducts research and development in all DOE mission areas. INEEL, like all other federal laboratories, also has a statutory mission to make its capabilities and technologies available across the federal government, to state and local government, and to universities and industry. To fulfill this technology transfer mission, INEEL encourages its scientific and technical staff to create new technologies and expertise and ensures that resulting intellectual property is identified, protected and made available to others who might benefit from it. In some cases, technologies are transferred to industrial partners for commercialization, creating jobs and delivering the benefits of federally funded technology to consumers. In other cases, unique capabilities are made available to other federal agencies or to regional small businesses to solve specific technical challenges. In other interactions, INEEL employees work collaboratively with researchers and other technical staff of our partners to further develop emerging technologies.

This report is a catalog a full year of certain INEEL technology transfer transactions in a single document. It covers INEEL accomplishments during fiscal year 2002. The size and diversity of INEEL technical resources, coupled with the large number of relationships with other organizations, virtually ensures that a report of this nature will fail to capture all interactions. Recognizing this limitation, this report focuses on transactions that are specifically authorized by technology transfer legislation (and corresponding contractual provisions) or involve the creation or transfer of legal rights to technology to other parties. The report does not attempt to capture the huge impact of technical interactions between INEEL researchers and their external colleagues through informal collaboration, technical publications and involvement in technical societies. Similarly, the report does not address the tremendous amount technology transfer impact achieved through INEEL involvement with and support for students and faculty at all levels of the educational system.

This report was compiled by the INEEL Technology Transfer and Commercialization organization (TT&C) primarily from records readily available to it. Most of the transactions are consummated through agreements and business systems for which TT&C is responsible. The accomplishments cataloged in the report, however, reflect the achievements and creativity of the highly skilled researchers, technicians, support staff and operators of the INEEL workforce. Their achievements and recognized capabilities are what make the accomplishments cataloged here possible. Without them, none of these transactions would occur.

The first section of the report catalogs and briefly describes the patents issued in fiscal year 2002 to Bechtel BWXT Idaho, Inc. (BBWI) and the federal government based on inventions made by INEEL researchers. The bulk of the report is devoted to technology interactions grouped by agreement type.

2002 Issued Patents

Intellectual Property (IP) in the form of copyrights and patents provides the foundation for interactions between national laboratories and other parties. The intellectual property estate of an R&D organization also serves as measure or the institution's ability to do creative, meaningful research. In the national laboratory system the primary focus is on patents. During fiscal year 2002, 30 U. S. patents were issued to BBWI or to DOE based on inventions of INEEL scientists and researchers. This performance is equal to that of the previous year and roughly in line with the past several years, though the trend is expected to move significantly upward over the next couple of years. In 2002, INEEL inventors submitted 105 invention disclosures to BBWI. Historically, 35-45 percent of invention disclosures in a given year result in issued patents.

BBWI has the right under its contract (subject to some exceptions) to elect to take title to inventions and seek patent coverage. The decision of whether or not to make that election and seek patent protection is based on market and technical assessments of the technology. A thorough market assessment is performed for each technology, and a recommendation is presented to an industry focus team, usually comprised of a department or project manager, assistant lab director or designee, market analyst, account executive, and patent counsel. These recommendations are presented before the team, where a final decision is made to elect or decline the technology for patent protection. Generally, if the invention is judged as commercially valuable, crucial to a primary mission, or valuable in terms of motivating further research funding, it is elected. If BBWI decides to decline title, DOE then makes a decision on whether to seek patent protection in its own name. If DOE decides not to seek patent protection, the inventor(s) may petition to have title waived to them by DOE with the expectation that they will pursue patent protection using their own resources.

A brief description of each patent issued during FY 2002 based on an INEEL invention is provided on the following pages.

Peter Kong and *Jon Grandy* teamed to produce a joint invention that was patented during the last fiscal year. The **Methods of Chemically Converting First Materials to Second Materials Utilizing Hybrid-Plasma Systems** patent describes a method of conversion based on flowing hydrocarbon material through a hybrid-plasma system. The invention is intended for use in chemical & materials synthesis, energy conversion, and coating deposition.

The **Hydrogen and Elemental Carbon Production from Natural Gas and Other Hydrocarbons** technology, by *Brent Detering and Peter Kong* was also patented during 2002. This technology can convert hydrocarbons into a substantially clean-burning hydrogen fuel that produces no greenhouse gas emissions. A useful by-product of the conversion process is elemental carbon in a powder form that can be used in several industrial processes.

The work of a team of current and former INEEL investigators was awarded a patent for the **Fast Quench Reactor and Method**. The team members were: *Brent Detering, Alan Donaldson, Jim Fincke, and Peter Kong*. A fast quench reactor employs a high temperature at the inlet and a convergent-divergent nozzle at the outlet. When reactants are injected into the reactor chamber, the resulting gaseous stream is rapidly cooled as it passes through the nozzle. This faster cooling preserves the desired characteristics that the material exhibited in the heated equilibrium reaction stage.

Tom Luther, Mason Harrup and Fred Stewart were involved in patenting **Polyesters Containing Phosphazene, Method for Synthesizing Polyesters Containing Phosphazene**. This technology processes diatomic hydrogen and unsaturated hydrocarbons as reactor gases in a fast quench reactor. Reheating the reactor gases during the fast quench is intended to allow the atomic weight of the output to be controlled.

The prolific team of inventors, *Joel Hubbell* and *Buck Sisson,* earned two more patents last year. **The Vadose Zone Isobaric Well** patent describes a well monitoring and referencing technology that is immune to atmospheric pressure changes and compensates for internal pressure changes. Their patent for the **Monitoring Well** describes a self-maintaining instrument for measuring soil water potential to determine characteristics of flow and transport in the vadose zone. It can be used in many mining, environmental, and industrial applications.

Dennis Bingham was the sole inventor on the **Apparatus for Pumping Liquids at or Below the Boiling Point**, which is a pump designed to better move liquefied gases through low-pressure processes. This technology is currently being licensed to NitroCision, Progressive Technologies Inc., and CS&P Cryogenics.

Dennis Bingham and *Russell Ferguson* were granted a patent for the **Method and Apparatus for Pressurizing Vaporous Fluids**. This single stage pump can produce pressures from a few pounds to hundreds of thousands of pounds, which previously required more expensive and complex multi-stage pumps. Pressurization systems of this type are widely used in many industries.

Another team of INEEL inventors, including *Dennis Bingham, Bruce Wilding, and Michael McKellar, was* awarded a patent for their **Apparatus and Process for the Refrigeration, Liquefaction and Separation of Gases with Varying Levels of Purity**. This technology is a process for separating and liquefying component gasses from a pressurized mixed gas stream and is part of a suite of technologies being developed under a multi-million dollar CRADA with PG&E and SoCal Edison.

Terry Turner received a patent for the **Apparatus and Method for Delivering Fluid to a Container**, a device for automatically and remotely delivering fluid into a vessel. This technology could be used in a variety of radiological, medical, and testing environments.

Terry also partnered with *Bruce Wilding, Michael McKellar, and Kevin Raterman* to earn a patent for the **Two Stroke Engine Exhaust Emissions Separator**. Two-stroke engines are widely used throughout the world because they are simple, lightweight, and powerful. They are less costly than comparable four-cycle engines and are commonly used on snowmobiles, motorcycles, and chainsaws. This technology offers an option to industries struggling to meet environmental challenges related to the need for decreasing emissions levels.

The INEEL received three separate patents that are improvements to a 1998 R&D 100 Award Winner, an electro-optic voltage sensor and system for measuring high voltages in electrical power transmission and distribution lines. It can replace large, expensive, direct contact transformer-based methods that are currently used. These patents are part of a suite licensed to International Business Ventures, Inc., of Clayburne, Texas for commercial development and include the **Electro-Optic Voltage Sensor for Sensing Voltage in an E-field**, by *James Davidson, Thomas Crawford, and Gary Seifert*, the **Voltage Sensing Systems and Methods for Passive Compensation of Temperature Related Intrinsic Phase Shift** by *James Davidson* with *Gordon Lassahn*, and the **Electro-Optic High Voltage Sensor Head** also by James *Davidson* in collaboration with *Gary Seifert*.

Jim Fincke received a patent for his **Method and System for Measuring Multiphase Flow Using Multiple Pressure Differentials**. This invention is an improvement on the system for measuring a multiphase flow in a pressure flow meter for calculating gas density, and is currently under license to FMC for use in metering gas at the well-head, less expensively and more accurately than previously thought possible.

A patent was awarded for the **Method for Non-Intrusively Identifying a Contained Material Utilizing Uncollided Nuclear Transmission Measurements** to *John Morrison*, *Blaine Grover*, and *Alan Stephens*. This patent is for an improved diagnostic method to identify contained target material and estimate ratios of a macroscopic neutron cross-section. It has use in a variety of fields, including national security.

Another in a suite of technologies developed by *Nancy Carlson, John Walter, John Johnson, and David Tow*, the **Apparatus and Method for Measuring the Thickness of a Coating**, is an invention that will be valuable in a variety of manufacturing and quality control applications. It is a method for determining the thickness of a coating on a substrate by examining the velocity of wavelengths induced in the coating.

Christopher Allen, Eric Peterson, and an outside collaborator teamed for the **Solid State Synthesis of Poly(Dichlorophosphazene)** patent. This environmentally-friendly technique can be used to make the family of polymers known as polyphosphazenes. The INEEL is widely recognized as the world leader in development of the materials and their applications. The technology is simpler, cleaner, and less expensive than current approaches.

The next patent is rather unique to the INEEL portfolio. The **Gender Determination of Avian Embryos** by *Keith Daum* and *David Atkinson*, is a method to determine gender in bird embryos using ion mobility spectrometry. Researchers and farmers often need birds of a specific gender for their work. This technology increases their efficiency by allowing them to incubate only eggs of the gender needed.

Herschel Smartt, John Johnson, Eric Larsen, Rodney Bitsoi, Ben Perrenoud, Karen Miller, and David Pace collaborated on the **Apparatus for the Concurrent Inspection of Partially Completed Welds**. This technology inspects welds in combination with a welder that moves reciprocally along the weld path. It can be used in construction, manufacturing, and a variety of other fields.

The **Methods and Systems for Seed Planting Management and Control** was another group-effort. An INEEL team of researchers, including, *John M Svoboda, Richard Hess, Reed Hoskinson, and David Harker,* invented this system to provide optimal spacing in a planted agricultural field. This technology can be used in planting seeds or plantlets of high-value crops such as vegetables and strawberries.

The **Method and Apparatus for Measuring the Mass Flow Rate of a Fluid** patent recognizes the efforts of *Robert Evans, Curtis Wilkins, Lorenzo Goodrich and Jonathan Blotter*. This invention came about through the need to measure the two-phase mass flow in a geothermal plant. This technology eliminates the common problem of fouling by placing the instrument external to the flow.

A significant patent in the area of water quality was awarded to *Ryan McMurtrey, Daniel Ginosar, Kenneth Moor, Michael Shook, John Moses, and Donna Barker* for their **Apparatus and Method for Extraction of Chemicals from Aquifer Remediation Effluent Water**. This technology

addresses the common problem of contamination of water with Dense Non Aqueous Phase Liquids. EPA estimates that over 10,000 contaminated sites exist nationwide.

The **Position Detectors, Methods of Detecting Position and Methods of Providing Positional Detectors** invention received a patent based on the work of *Dave Weinberg, Dean Harding, and Eric Larsen*. The patent is currently licensed to Saipem, an Italian offshore pipeline manufacturer. The device was developed to provide location information on automatic weld heads and inspection sensors during the welding and inspection process.

Vance Deason and Ken Telschow partnered to develop the **Method and Apparatus for Detecting Internal Structures of Bulk Objects Using Acoustic Imaging**. Based on the previously patented INEEL Laser Ultrasonic Camera, this patent extends the usefulness of the camera to discovering buried defects or other internal features in solid objects. Applications include nondestructive testing and materials research using ultrasonics.

A patent was awarded for the work of *Stuart Snyder, Judy Partin, Jon Grandy, and Charles Jeffery* for the **Ambient Method and Apparatus for Rapid Laser Trace Constituent Analysis**. Laser Induced Breakdown Spectroscopy and Laser Induced Fluorescence are used in combination to measure the absorption rate of a material. By comparing the rate against a known value, the amount of material in the sample can be determined. This technique could be used in a number of industries where detection of trace amounts of contaminants is important.

Oleg Kotlyar was awarded two separate patents during the last fiscal year for the **Mechanical Seal Assembly**, which is an improvement on existing seals, which are subject to substantial vibration stress.

A patent was awarded for the **Method for Non-Intrusively Identifying Contained Material Utilizing Uncollided Nuclear Transmission Measurements** to *John Morrison*, *Blaine Grover*, and *Alan Stephens*. This patent is for an improved diagnostic method to identify contained target material and estimate ratios of a macroscopic neutron cross-section. It has use in a variety of fields, including national security.

The **Multiple Cell Radiation Detector System, and Method, and Submersible Sonde** was developed by *Larry O. Johnson, Charles McIsaac, Robert Lawrence, and Ervin Grafwallner*. This technology is a self-contained radiation detector system for the detection of radionuclides in boreholes, groundwater, effluent streams, soils, and in other environmental applications.

Dieter Knecht and *Troy Tranter* developed the **Open-Cell Glass Crystalline Porous Material** technology that was also awarded a patent in 2002. This technology is a porous material made from hollow microspheres that are bound together and can be used to absorb and immobolize radioactive nuclear waste. It is also useful in a variety of other applications including heat-resisitant filtration systems, supports for catalysts, adsorbents, and ion-exchangers.

Spin-offs

Spin-off businesses commercialize the INEEL's technology and expertise. The taxpayer benefits from spin-off activities when commercially viable technologies, which solve both governmental and private sector issues, are provided to the public. During FY 2002, the INEEL has helped to launch two spin-off companies, TetriDyn Solutions and NanoSteel.

TetriDyn, Solutions, Inc.
TetriDyn Solutions, Inc., is an INEEL spin-off that will specialize in providing solutions to data integration problems faced by industries today. The technology, Merlin Data Integration provides solutions in integrating disparate applications and associated data across an enterprise, between companies, and within smaller workgroups. TetriDyn has exclusively licensed the INEEL developed software product Merlin Data Integration. TetriDyn's headquarters is located in Pocatello, Idaho.

The NanoSteel Company
In July 2002, an exclusive worldwide license was granted to The NanoSteel Company, a newly formed entity established for the commercialization of "Devitrified Nano Composite Steels" better known as Super Hard Steel.

The company will be establishing an R&D facility in Idaho Falls, Idaho, with plans to also build a pilot scale powder production facility in Idaho Falls. Participants in the newly formed company include Caterpillar, Engelhard Corporation (an industry leader in thermal spray applications), MILCOM Technologies (a company that specializes in high technology start-ups) and local Idaho Falls investors. Initial capitalize is established at $20,000,000 and the license calls for royalties over the life of the license of $4,000,000-plus paid to the INEEL.

Utilization of Licensing Income

Federal laboratories are entitled to use the income generated by their licensing activities. The laws that establish the laboratory mission in technology transfer provide that a portion of licensing income will be shared with the inventors of licensed technology with the remainder, referred to as the laboratory share, available to the laboratory for a wide variety purposes. Of the $582K of licensing income received in the fiscal year 2002, $185K was distributed to INEEL inventors.

Funds from the laboratory share were dispersed to support the following activities:

- Funds were utilized to continue uninterrupted work towards prototype development to complete development and fabrication of the small-scale liquefier and L/CNG fueling station. PI: Bruce Wilding

- Support the transfer of the Electro-Optic High Voltage Sensor (EOHV) technology. PI: Gary Seifert

- Support patenting activities and technology transfer assistance to RSP Tooling. PI: Kevin McHugh

- Funds assisted researchers to test the production of borohydride using the INEEL non-thermal plasma reactor. These funds were utilized to set up the INEEL non-thermal plasma reactor to run tests, supplies and labor costs. PI: Kerry Klinger

- Funded technical writers to prepare the nomination for the Federal Laboratory Consortium Award Nominations for technologies "Positron Annihilation" and "Sodium Lactate Injection."

- Super Hard Steel technology commercialization efforts. PI: Daniel Branagan

- Publicity coverage for the RSP Tooling license signing in Cleveland, Ohio.

- Cover closeout costs toward the Neptune Project. PI: David M Weinberg

- Perform the scope of work for the Clean Coal Energy Facility evaluation process. PI: Lloyd Brown

- Sponsored expenditures to have INEEL representation at the Third Annual Solid State Energy Conversion Alliance Workshop. PI: Paul Lessing

- The 6th Annual INEEL Inventors' Recognition Banquet, held in February 2002 to honor the accomplishments and contributions of INEEL inventors.

- Supported Mark McKay's research in autonomous aerial navigational and positioning systems in the Robotics Laboratory. Bringing this technology to a deployable stage would give INEEL opportunities. PI: Mark McKay

- Supported the 2nd annual INEEL Science and Engineering Expo in conjunction with the 1st annual Idaho Falls Arts Council Snake River Roaring Youth Jam. PI: Elda Zounar-Harbour

- Funded further development of the INEEL potato seed monitoring system to determine the technical feasibility. PI: Reed Hoskinson

- Researchers conducted testing and evaluation of the LNG liquefaction system developed by INEEL. PI: Bruce Wilding

- The Potato Disease Detection research team performed field tests to support the research they have done and are in the process of doing. Further development required field tests of the system in a potato cellar environment, and experiments were needed to be run to determine the optimal ion source configuration for disease detection. PI: David Atkinson, Robert Ewing and David Miller

- Sponsored profiles of two INEEL R&D 100 award winners, Ken Telschow and John Flinn in *R&D* Magazine.

- Supported the In Situ Bioreactor (ISB) in the vadose zone tracer study utilizing sulfurhexaflouride (SF6) and an ion mobility mass spectrometer. PI: Brad Blackwelder

- Supported the Subsurface Barrier (SSB) research team to verify and monitor performance of the SSB for the Obayashi integrated system demonstration. PI: Reva Nickelson, John Richardson and Kevin Kostelnik

INEEL-Developed Technologies Licensed to Established Firms

Major Fee-Bearing Agreements

Devitrified Nanocomposite Steels - In July 2002 the INEEL executed an exclusive worldwide license agreement to The NanoSteel Company, a newly formed entity established for the commercialization of "Devitrified Nanocomposite Steels" better known as Super Hard Steel.

The company will be establishing an R&D facility in Idaho Falls, ID with plans to also build a pilot scale powder production facility in Idaho Falls. Participants in the newly formed company include Caterpillar; Engelhard Corporation (an industry leader in thermal spray applications); and MILCOM Technologies (a company that specializes in high technology start-ups) and local Idaho Falls investors. Initial capitalize is established at $20,000,000 and the license calls for royalties over the life of the license of $4,000,000-plus paid to the INEEL.
Associated technologies: B-048, Low Friction Wear Resistance Steel; B-180, Hard Steel Ingots and Methodology to Increase Toughness While Retaining or Increasing Hardness; LIT-PI-387, Devitrified Nanocomposite Steels

Merlin Mediation System – The INEEL exclusively licensed the Merlin Mediation System technology to Tetridyn Solutions, Inc. in October 2001. The Merlin software suite provides enterprise-wide data integration of disparate and distributed data sources. Tetridyn specializes in providing solutions to the data integration problems faced by industries today.

Tetridyn Solutions is also a newly formed INEEL spin-out company located in Pocatello, Idaho.
Associated technology: B-110/SW-MERLIN; Merlin Mediation System

Multiphase Flowmeter – The INEEL exclusively licensed High Void-Fraction Multiphase Flowmeter to FMC Services in Texas. The inexpensive High Void-Fraction Multiphase Flowmeter sidesteps the volume distortion problem common to conventional meters, allowing real time, continuous, and accurate measurement of gas and liquid. This technology won an R&D award in 1999, and an Award for Excellence in Technology Transfer from the Federal Laboratory Consortium in 2001.
Associated technologies: LIT-PI-199A, Improved Method and System for Measuring Multiphase Flow Using Multiple Pressure Differentials; LIT-PI-199A1, Improved Method and System for Measuring Multiphase Flow Using Multiple Pressure Differentials; LIT-PI-199B, Improved System for Measuring Multiphase Flow Using Multiple Pressure Differentials; LIT-PI-199B1, Multiphase Flow Calculation Software; SW-DPMPFS, Differential Pressure/Multi-phase Flow Software

Rapid Solidification Process (RSP) - RSP Tooling, LLC has acquired an exclusive FOU license from the INEEL to commercialize the INEEL developed technology Rapid Solidification Process (RSP) for tool and die-making. This process provides significant energy and cost savings to the tool and die-making industry by reducing the time of manufacturing and improving tool life, which benefits the customer. The award winning technology has been recognized with the R&D 100 Award, DOE's Energy @23 Award, and the Federal Laboratory Consortium Award.

RSP Tooling LLC will commercialize the RSP technology by building and selling an automated, commercial system for the manufacture of molds and dies for die-casting, forging, and other molding applications. The intellectual property covered under the License Agreement includes: 264, Apparatus and Method for Spraying Liquid Materials; 605A, Pressurized Feed-Injection Spray-Forming Apparatus and Process; 612A, Spray Forming Process for Producing Molds, Dies, and Related Tooling; 612A1, Spray Forming System for Producing Molds, Dies, and Related Tooling; 612A1A, Rapid Solidification Processing System for Producing Molds, Dies and Related Tooling; B-073, Method and Apparatus for Producing Molds, Dies, and Related Tooling with Improved Properties; LIT-PI-220, Spray Forming Method for Selective Build-Up of Metal Deposits

Fast Quench Reactor and Method – INEEL has signed a License Option agreement with PPG Industries, Inc. for the Nanopowder technology. The license option grant allows PPG to enter into a royalty bearing license to manufacture and sell nanopowder of ceramics and other metal forms. The intellectual property includes: Associated technologies: 413, Method for Making Titanium Metal Powder Directly from Titanium Tetrachloride Using a Plasma Quench Reactor; 413A, Fast Quench Reactor and Method; 413RE, Fast Quench Reactor and Method; B-026, Improved Method for Acetylene Production by Thermal Decomposition of Natural Gas

Cooperative Research and Development Programs

A Cooperative Research and Development Agreement or CRADA is an agreement between a federal laboratory and one or more non-federal parties, referred to as participants, to collaborate in research and development aimed at the introduction of new technology into a government or private market. The CRADA mechanism was established by federal legislation to increase the access of non-federal parties to the science and technology resources of the federal government. The key distinguishing element of a CRADA is its collaborative element – both the laboratory and the participant(s) commit resources to the relationship. The resources committed under a CRADA can include cash, intellectual property rights, technical capabilities, market intelligence, access to specialized research or manufacturing facilities or equipment, etc. The one notable constraint on the exchange of resources under a CRADA is that the laboratory may not provide cash to a participant. Successful CRADA relationships are frequently based upon or followed by a license of INEEL patents to the participant(s).

INEEL has distinguished itself among DOE laboratories with its record of aggressively securing leverage for federal funds in its CRADA relationships. During 2002, INEEL consummated 8 new CRADA relationships with various parties and ten modifications to existing CRADAs. A CRADA may be as short as a period of months or may extend several years depending on the objectives of the collaboration. The total projected commitment of resources to these 2002 funds-in/in-kind CRADA actions by all parties will be $3.4M over the term of relationship. Of that resource commitment, approximately $1.2M (including $729K funds-in) will come from the participants with remainder representing federal resources. The number of transactions and the corresponding resource commitments vary considerably from year to year based on the technologies available at INEEL, the readiness of participants to invest in collaborations, and INEEL's ability to identify the right partners and negotiate satisfactory business relationships.

A brief description of each new CRADA relationship executed during 2002 is provided below.

02,CR-09, "Small-Scale Liquefaction Testing and Evaluation"
Partner: Ruby Mountain, Inc.
Industry Focus Team: Oil and Gas
Total Value: $60,000
PI: Bruce Wilding
Abstract: The INEEL has been part of a joint development project with industry and the Department of Energy to design, engineer, fabricate and evaluate a 10,000 gallon per day pressure letdown system to liquefy natural gas extracted from transmission pipeline gas systems that have downstream distribution at city gate locations. The initial system has been designed to produce transportation quality liquefied natural gas ("LNG") for use in LNG fueling systems.
Date Signed: 9/19/02

02-CR-04, "Methodology For Conducting Probalistic Risk Assessment Of Carbon Dioxide Storage in Coal"
Partner: BP Corporation North America, Inc.
Industry Focus Team: Oil & Gas
Total Value: $548,300
PI: Jenn-Tai Liang
Abstract: The proposed research under this CRADA directly relates to missions with Fossil Energy as well as the National Climate Change Technical Initiative by investigating ways to control greenhouse gases. The goal of this project is to provide a methodology acceptable to regulators and the public alike by which to conduct a meaningful probability based risk assessment of CO2 injection and storage in coal beds. Consequently, the work will develop the necessary knowledge, tools, and strategies for risk evaluation, risk mitigation, and monitoring and verification. The work will be conducted within the context of an actual field demonstration of the technology thereby allowing for real-time feedback and validation. The proposed Scope of Work will be funded through a joint collaboration with the BP Corporation North America Inc ("BP") and the Department of Energy ("DOE").
Date Signed: 4/19/02

02-CR-07, "Ceramic Membrane Reactor for Syngas Production"
Partner: ITN Energy Systems, Inc.
Industry Focus Team: manufacturing and oil & gas
Total Value: $925,000
PI: Raymond Anderson
Abstract: Production of syngas followed by Fischer Tropsch (FT) synthesis can produce ultra-clean fuels but commercial utilization of this technology has been limited due to high production costs. For subsequent FT processing, the best process for syngas production is partial oxidation, which requires a source of pure oxygen. In the approach to be taken in this project, an ion conducting ceramic membrane (ICCM) catalytic reactor combines the oxygen separation and oxidation functions. There are both materials and manufacture challenges to be met in this approach. Materials challenges include requirements that the membranes be both ion and electron conducting, have a high flux rate for oxygen transport, be chemically stable to difficult operating conditions, and have mechanical stability. Membrane module manufacturing offers challenges in providing sealing between the natural gas and air sides of the membranes as well as gas manifolding for feed input and product output, membranes need to be compatible with module materials both in terms of chemical stability and thermal expansion matching and need to be manufactured in a high volume and inexpensively.
Date Signed: 6/14/02

02-CR-08, "Application of Ion Mobility Spectrometry for Detection of Potato Diseases"
Partner: Insightek
Industry Focus Team: chemical and agricultural
Total Value: $37,700
PI: David Atkinson
Abstract: The scope of the joint development program is to develop a system for identifying the presence of economically important plant diseases. Insightek and the INEEL will determine the capability of the INEEL's "Ion Mobility Spectrometry" (IMS) technology for sensing disease symptoms of stored potatoes. The specific disease pathogens to be evaluated include two species of Phytophthora, Pythium and Erwinia. The development program will also focus on extending the detection system to pin point the location as well as to classify the type of infection.
Date Signed: 5/24/02

02-CR-05, "Neutron Detection System"
Partners: Advanced Research and Applications, Corporation (ARACOR) and Los Alamos National Laboratory
Industry Focus Teams: nuclear, transportation, instrumentation and law enforcement
Total Value: $900,000
PI: James Jones
Abstract: Develop and test nuclear materials detector systems that can be integrated with mobile or fixed- site high-energy x-ray inspection systems. The baseline for these detector systems will be the Eagle, a mobile x-ray inspection system manufactured by ARACOR. This will include cooperative research and development between ARACOR, INEEL, and LANL.
Date Signed: 07/23/02

02-CR-15, "Subsurface Engineering and Technology Development Project"
Partner: Boart Longyear Company
Industry Focus Team: mining
Total Value: $70,000
PI: Jerry May
Abstract: The Idaho National Engineering and Environmental Laboratory and Boart Longyear Company are jointly interested in developing new and innovative technologies for accessing, identifying and analyzing subsurface materials and constituencies. The objective is to identify technology research and development projects, which will support and benefit both INEEL and Boart Longyear's environmental and subsurface mission and activities.
Date Signed: 07/30/02

02-CR-01 "Silicon Carbide and Boron Carbide Armor Material Development"
Partner: Superior Graphite Co.
Industry Focus Team: Manufacturing and Law Enforcement
Total Value: $100,000
PI: Henry Chu
Abstract: The INEEL and Superior Graphite Co. will collaborate in the development of a low-cost silicon carbide ceramic, a boron carbide/silicon carbide composite and a silicon carbide reinforced silicon carbide matrix composite for armor applications. For many years there has been a lot of work done to identify an optimal, cost effective material for use in armoring applications. Over the

last couple of months, there has been increased interest in the field of Security, with specific demands for better armor material and systems. The Superior Graphite Company is one such company that has expressed significant interest in getting into the Armor Business. Because of the Specific Manufacturing Project going on at the INEEL, the INEEL has gained vast amounts of knowledge in ballistics and material characteristics. This expertise will be utilized in the course of work under this CRADA.
Date Signed: 12/14/01

02-CR-02 "Development of Membrane Separators and Catalysis"
Partner: Giner Electrochemical Systems, LLC
Industry Focus Team: manufacturing and chemical
Total Value: $100,000
PI: Frederick Stewart
Abstract: The proposed research and development activity is in the area of new membrane separators and catalysis. The joint activity is to further GES and INEEL's efforts in this area, which will result in improved fuel cells and energy efficiency.
Date Signed: 3/15/02

Corporate Funded Research and Development

Under the terms of the contract between BBWI and DOE, the corporate parents of BBWI are reinvesting a predetermined portion of their fee in R&D efforts relevant to INEEL missions. This unique contract feature was proposed by BBWI as a means of revitalizing the laboratory. Most of the funding under this Corporate-Funded Research and Development (CFRD) program is spent at the INEEL. CFRD projects executed by INEEL personnel utilize the WFO agreement mechanism. The contract terms establish a minimum annual investment of $1.5 million and a maximum of more than $8 million. The corporate parents have approved over $25 million to fund CFRD projects, since the start of the contract.

CFRD projects must serve an advanced technical need of the sponsoring parent and either enhance INEEL capabilities to meet a DOE mission or facilitate commercialization of an INEEL technology.

A brief description of each of the CFRD projects approved in 2002 is provided below.

High Explosive Knowledge Preservation
The U.S. Department of Energy (DOE) Pantex Plant is developing a strategy to establish a National Center for Explosive Fabrication Technology (NCEFT) at Pantex. The strategy addresses the need to implement new methods for producing weapons components in a better/cheaper/faster manner while maintaining ultimate standards of operator safety and environmental stewardship.

The Knowledge Perservation of High Explosives project will serve as a cornerstone in the development of the Pantex NCEFT by providing immediate improvements to the explosives processing and fabrication techniques at Pantex through system optimization. This project is in progress at Pantex and at the Idaho National Engineering and Environmental Laboratory (INEEL). The INEEL is developing computer-based production models of the high explosives production process to train and teach other plant personnel.

High explosives used in the DOE weapon systems are generally developed through chemical synthesis processes followed by a formulation process. We propose to optimize this process through the implementation and enhancement of the INEEL GOTH-SNF process optimization modeling system. GOTH_SNF is an INEEL deployed software currently in use for modeling spent nuclear fuel processes to optimize safety, cost, and performance requirements.
The GOTH-SNF system is currently undergoing enhancements sponsored by Pantex through Plant Directed Research and Development (PDRD) funding. For FY-03 the INEEL is proposing to Pantex to obtain additional PDRD funds to continue synthesis modeling of the nitration and amination processes in the manufacture of triaminotrinitrobenzene (TATB) and the synthesis of hexanitro-stilbene (HNS).
This Corporate Funded Research and Development (CFRD) proposal adds features to the code that improve the execution speed, robustness, and user interface. These enhancements are needed to complete the Pantex process optimization work in FY-02 and FY-03 timeframe. In addition to completing the Pantex process these code enhancements will attract future partners or customers.

Ultrafiltration
The INEEL research staff will utilize existing INTEC laboratory facilities to perform bench-scale tests. A bench-scale cross flow filter test apparatus exists at the INTEC facility to support the INEEL High-Level Waste program. This unit will be utilized for testing, but several new metal cross flow membranes will need to be purchased for this effort (different pore sizes, membrane type (sintered metal, mesh, TiO_2 coating, etc.) and materials of construction to allow more aggressive chemical cleaning, if necessary. Particle size distribution of suspended solids will be measured in an existing Coulter LS230 Laser Diffraction Particle Size Analyzer with resolution of 0.04 to 2000 μm.

Frequent interactions and discussions will be held with the WTP Hanford personnel to ensure project requirements are being met and any changes to the project get communicated to research personnel. Interactions between PNNL and SRS will also take place to transfer data and participate in limited testing.

Hanford tank waste simulates and solids will be developed, prepared (consistent with those used at PNNL and SRS) and characterized. These simulated wastes will include various sludge

compositions from multiple tanks and may also include simulated entrained solids and Sr/TRU precipitates, depending on current needs of the Hanford WTP project. Parametric studies will be performed to evaluate filtrate flux for a given waste, filter media and size, and operating parameters (transmembrane pressure, and axial velocity). Testing will be established on a two-parameter, central composite design. After each test, the filter will be backpulsed to restore it to a consistent starting point and fluxes verified using deionized water. After severe fouling is observed, chemical cleaning methods will be tested to attempt to restore the filter membrane to near original fluxes. Cleaning methods/procedures as well as reagents (water, nitric acid, and other reagents) will be developed/tested in the crossflow filter unit using simulated wastes.

Next Generation Wireless Simulation & Integrated Virtual Demonstration

Bechtel Telecommunications plans to perform integrated testing for multiple vendors of next generation wireless communications systems, including 3rd Generation or "3G" cell phone systems, new high-frequency microwave backhaul links, and Free-Space Optics (FSO). These new systems will integrate voice and data communication technologies, and increase handset bandwidth from less than 14.4Kb/s eventually up to 2Mb/s. This increased bandwidth could provide things like "broadband" access to Internet, streaming video functions on cell phones, and other futuristic handheld or mobile devices. The rollout of 3G networks will involve deploying new technologies at every level: new handsets, new frequencies, new antenna arrays, new cell configurations that are optimized for both data and voice coverage (their coverage areas are not the same), massive upgrade of cell controllers' "land-line" phone links from low bandwidth connections (typically T-1's at 1.5 Mb/s) to higher capacity fiber (like OC-3 at 150 Mb/s), and integration of voice switching and Internet network protocols (Voice-Over-IP, Web phones). 3G systems are expected to greatly transform our nation's communications infrastructure and the types of services it provides. With almost 900 square miles of isolated flat desert and a broad base of technical personnel who can directly work on all aspects of this system -- applied research, engineering design, operations and test activities, and scientific analyses -- INEEL provides "one-stop" testing for wireless service providers.

There is no single vendor source for all the telecommunications equipment needed for these technological upgrades, and no one entity is providing end-to-end testing or independent validation. The reasons for this are numerous and include: rapidly changing technology; the lack of a single national transmission standard and progression of multiple technologies (TDMA, GSM, GPRS, EDGE, UMTS, CDMA, WCDMA, etc.); problems obtaining FCC frequency bands; finding geographically isolated and low-noise radio frequency (RF) test areas; and acquiring controlled access to isolated high-speed networks. As a federal reservation and multi-program laboratory, Idaho National Engineering and Environmental Laboratory (INEEL) can provide all these capabilities in one location. INEEL's independent status as a government laboratory and broad historical experience with Independent Validation and Verification (IV&V) for military, NRC, and other commercial customers is of significant value.

This cooperative effort will create a large-scale, end-to-end, National Wireless Test Bed (NWTB) for independent testing of the next generation of integrated voice and data communications for mobile users. Bechtel Telecommunications will provide access to interested test bed customers, engineering/design experience in building communications systems, and experience in developing communications acceptance test procedures. INEEL will provide vast physical infrastructure

including large open geographical areas, RF test frequencies, power, and access to high-speed data communications links. INEEL can also support all aspects of designing, simulating, formal testing, and analyzing the results as well as supporting this infrastructure. INEEL provides Bechtel Telecommunications with "one stop shopping" for an integrated test environment.

In preparation for full NWTB operation, there are several capabilities at the INEEL that need to be enhanced or created to attract both the creation of the NWTB and a steady stream of long-term customers. This CFRD project seeks to develop these capabilities to ensure that INEEL is a viable NWTB site, that infrastructure for consistent collaboration between Bechtel Telecommunications and INEEL exists, and to expand/accelerate the interested customer base to attract stable, long-term funding in the wireless communications arena.

Work for Others

Work for Others (WFO) refers to work performed solely by the laboratory for parties other than the Department of Energy (DOE). WFO differs from a CRADA in that the laboratory performs all of the work and all costs are recovered from the sponsor. WFO includes work for other federal agencies and work for non-federal agencies (private companies, universities, state and local government agencies, tribal governments, and foreign entities). WFO does not include work for the DOE, other DOE laboratories or contractors, or work that is funded in total or in part by DOE. DOE Order 481.1B governs all WFO activities.

The primary purpose of WFO is to make available the wealth of technologies, expertise and facilities in which Federal funds have been invested. Under the Economy Act of 1932 DOE is authorized to provide the capabilities, which are unique and not readily available in the private sector to other Federal Agencies. Under DOE policy, these resources are also made available to the public and private sectors to benefit programs of national importance and to enhance industrial competitiveness.

WFO is conducted on a full cost recovery basis and may not interfere with execution of a DOE mission. WFO projects are conducted on a best-efforts basis pursuant to agreements reached among INEEL, DOE, and a sponsor. These projects are conducted at no cost to DOE. In fact, because of cost allocation practices, WFO sponsors actually reduce landlord costs to DOE by subsidizing fixed infrastructure and service costs that would otherwise accrue to the DOE budget. WFO also contributes to a greater technical base at the Laboratory.

There are approximately 120 active projects underway at any given time. Each year several dozen new projects are initiated and several dozen current projects are completed. During 2002, 46 new projects were approved, and total WFO funding received was just under $111M, up 11 percent from the previous year. Approximately 35% of WFO funds received in 2002 were for R&D efforts with the remainder supporting specialized manufacturing operations and other industrial-type activities, some of which are driven by international agreements. In recent years approximately 90% of WFO funding is from other federal agencies and 10% comes from non-federal sponsors.

A brief description of each of the new projects approved and funded during 2002 is provided below. Of the 46 new projects, 5 were sponsored by a corporate parent of BBWI. Descriptions of those projects are grouped under the heading of Corporate-Funded Research and Development below.

Ford Nuclear Reactor Decommissioning – U of M
University of Michigan (UofM) has recently announced plans to decommission the Ford Nuclear Reactor (FNR). The FNR is a 2 MW pool type research reactor (19.5% U-235 enrichment fuel) that has been in operation since 1957. The U of M needs an individual to serve as a consultant to the FNR Decommissioning Team. This consultant will provide expert advice to the Decommissioning Team as it begins the initial stages of the Decommissioning and Decontamination (D&D) process. This will aid the UofM in providing decommissioning subcontractors with an accurate scope of work required and aid in obtaining the best subcontractor for the job..

Rio Technical Services Inc. Master Task Agreement
RIO Technical Services, Inc. ("RIO") was formed in 1995 and is a privately held small business. RIO is headquartered in Fort Worth, Texas, and is organized into three operating units: Government Programs, Technical Programs and Commercial Programs. RIO has employees working at commercial nuclear facilities, Department of Energy National Labs, and on engineering projects throughout the United States and Western Europe.

The work proposed under this Master Task Agreement include projects related to national security, waste management, long-term stewardship, decontamination/decommissioning, environmental management, storage and transportation of spent nuclear material, licensing of Department of Energy facilities with the Nuclear Regulatory Commission and development of Advanced Power Systems including fuel cells, advanced turbines and hybrid fuel cell turbines.

In conjunction with these activities, RIO proposes to engage personnel from the Idaho National Engineering and Environmental Laboratory ("INEEL") to provide training and consultative support in national security, waste management, long-term stewardship, decontamination/ decommissioning, environmental management, storage and transportation of spent nuclear material and advanced power systems.

Big Rock Point Task
The Idaho National Engineering and Environmental Laboratory (INEEL) has been requested by Consumers Energy to provide license engineering support services for its application for a site specific Nuclear Regulatory Commission (NRC) license for the Big Rock Point (BRP) Independent Spent Fuel Storage Installation (ISFSI) under the provisions of 10 CFR Part 72. Consumers Energy is currently constructing and loading the BRP ISFSI under a general license using the provisions for holders of a 10 CFR Part 50 reactor license. Consumers Energy plans to decommission the reactor and terminate the Part 50 license. Prior to the Part 50 termination, a Part 72 specific license will be required.

The scope of work will include, but not necessarily be limited to, assistance with development of the license application package for the BRP ISFSI (Docket No. 72-43). License Engineering will be provided to support the Application Summary, Technical Specifications, Environmental Report, Safety Analysis Report, Physical Protection (Security) Plan, Emergency Plan, and

Decommissioning Plan. Related program activities potentially requiring license engineering support may include facility operation, fuel handling and loading, maintenance, emergency preparedness, training, records center development, quality assurance, radiation protection, and radiological environmental monitoring.

The scope for subtask 1.1 will be an on-site visit by two people from the INEEL to establish points of contact with the Consumers Energy Big Rock Point (BRP) facility, obtain the current status of the ISFSI license conversion, and collect necessary data and documents. Subsequent to review of the data and documents, the INEEL will generate and transmit a report to BRP with recommendations that will facilitate the license conversion process consistent with the remote management model used at the Fort Saint Vrain (FSV) ISFSI. At the direction of BRP, the INEEL will also provide level of effort consulting in the areas detailed in the Task 1 Request for Services.

Eastern Idaho Economic Development Council

The Eastern Idaho Economic Development Council (EIEDC) as the designated representative of the Eastern Idaho Community Reuse Organization (EICRO) has requested technical and project management services to support the turnover and conversion for community use of the Coal Fired Steam Generating Facility (CFSGF) at the Idaho National Engineering and Environmental Laboratory. The EICRO is the organization funded by DOE-HQ to mitigate economic impacts of DOE Complex downsizing to the seven counties surrounding the INEEL. The EICRO is the designated organization to receive surplus, underused or unused equipment and facilities at the INEEL. The CFSGF will be leased to the EICRO, subsequently leased to an Independent Power Producer (IPP), and then converted to be the Clean Coal Energy Facility (CCEF). The purpose of the CCEF is to generate electric power and be used as a test bed for clean coal and clean energy technology demonstration. EIRCO is not an engineering or technical development organization. EIRCO does not have staffing capability necessary to support this activity. There are no coal-fired electricity generating plants or energy technology demonstration facilities in Idaho or in areas proximal to southeast Idaho. EIRCO needs one key individual to perform technical and management support for the CCEF lease and conversion process. EIRCO cannot economically or locally acquire from the private sector the technical and management services necessary to support the complex technical, regulatory and financial endeavor to lease, convert and operate the CCEF. EIRCO has determined that the INEEL is the only regional source of expertise available.

Support will be required for the three phases of the turnover process: The DOE-ID/EICRO lease process, the DOE-ID/EIRCO and Independent Power Producer (IPP) Interface Memorandum of Agreement process and the final facility interface and turnover process.

BBWI will provide technical and project management support to facilitate the lease and turnover of the CFSGF to the EIRCO. Primary tasks will include support for negotiation of utility interface agreements, easement definitions, facility baseline assessments, safety and health determinations, permitting agreements and operations interfaces. BBWI will support the EICRO in the development of agreements with regional companies for long-term use of the CFSGF as an electric power producing plant and as a research and development facility supporting demonstrations of clean coal and clean energy technologies to support national energy needs. Flowdown requirements of the DOE-ID/EICRO lease agreement will be converted into contractual agreements

between EICRO and the IPP. During the final phase of the turnover process, BBWI will support EICRO in the completion and documentation of facility and records transfer, permit finalization and EICRO/IPP and INEEL interface and operation agreement finalization.

Isotope Processing and Shipping

To ensure a continuous supply of radioisotopes for US commercial industrial and medical applications, I4 has been irradiating cobalt isotopes at the ATR for the past several years. These targets belong to I4. Completed targets are stored in the ATR canal. Customers have now been identified for seven of the irradiated cobalt targets. They need to be removed from the ATR water storage and placed in shipping containers for shipment to the customers. INEEL's contractor labor support at the ATR is required to process and ship these targets to the isotope customers. The intended customer is GE. They are prepared to receive and handle the targets, once shipped. Test Reactor Area, Nuclear Operations personnel associated with the support of the TRA are the only ones that would be allowed to take items from the storage canals. The targets are radioactive and have very specific handling requirements to assure safety of those working with them and other people at the ATR. The people and equipment resources to do this work are readily available at ATR. The isotopes are already irradiated and stored in the ATR pools. The The targets are radioactive and have very specific handling requirements to assure safety of those working with them and other people at the ATR. The people and equipment resources to do this work are readily available at ATR. Industry would not be allowed to come into the ATR to do this work. This fulfills a mission of DOE to provide isotopes. The revenue from this project offsets some of the operating costs of the ATR which is currently running at much less than capacity. International Isotopes has been using the ATR to create isotopes for the past six years. The INEEL is one of the few places where these isotopes can be created.

Detection of Fuel Rods in Buried Waste

Several nuclear fuel rods from the Millstone nuclear reactor may be in waste boxes buried between 25 and 40 ft. underground at the US Ecology facility on the Hanford Reservation in Richland Washington. These boxes also contain irradiated reactor components. The SNF needs to be removed. Phase 1 ($10,505) - Conduct an initial assessment of the site, collect available data for the Millstone fuel rods and prepare a preliminary safety assessment for placing detection tubes in the ground.

Phase 2 ($125,000 est.)- Prepare detailed development of the assay system, collect data and analyze results. INEEL has adequate resources available to perform the requested field work at Hanford and to analyze the results. One person for forty hours of on site work and sixty hours of analysis work will be required during Phase 1 of this two-phase project.

Up to four people will be needed to conduct field data acquisition work for a period of one week during Pahse 2 Doug Akers has filed an invention disclosure record and INEEL has elected to file a patent application for the technology being deployed during Phase 2. Industry does not possess the technology needed to conduct this in-situ evaluation. This kind of work, using Doug Aker's proprietary method, has been previously performed at INTEC. A DOE site clearance is required.

Doug Akers, as the inventor, is uniquely qualified to perform this work requested. Additional field deployment of Doug Akers' proprietary technology will provide additional verification of its capabilities and improve DOE's ability to license the product. Identification and removal of buried SNF will reduce the possible environmental impact at DOE's Hanford Reservation. This newly developed nuclear characterization technology supports INEEL's mission as the lead Nucelar and Environmental Laboratory. Transferring this technology to benefit other laboratories is also consistent with the goals of BBWI's Technology Transfer and Commercialization office. Washington State Law, the Dept. of Health is prohibited from providing funds prior to conducting this work. Where state laws expressly prohibit prepayment, DOE has approved a waiver of this requirement. Attached with the request for services form was a letter precisely defining the State Law that prohits prepayment. The Dept. of Health has been notified that INEEL must recover all costs.

INEEL Fusion Safety Program Work Proposal:
Aerosol Dynamics in the Laser IFE Chamber System

Three tasks to be performed by the INEEL Fusion Safety Program will contribute in the development of the UCSD laser IFE chamber-clearing model. These tasks will provide an essential understanding of possible aerosol generation and growth mechanisms in the laser IFE system. Scoping studies of individual mechanisms have shown that chamber conditions and time scales are suitable for aerosol formation via condensation of vaporized material. The intent of the proposed work is to examine in greater detail the dynamic behavior of aerosols subject to various nucleation and growth mechanisms following each micro-explosion in the chamber. A pervasive aerosol population in the chamber could create undesirable conditions in the chamber for subsequent shots. Particulate may absorb and deflect driver energy, deposit on optics, create instabilities in the target trajectory, inadvertently affect target tracking, and reduce debris-pumping efficiency. Knowledge of possible aerosol sources in laser-based IFE systems will aid in the design of chambers that minimize the impact of aerosols on system performance.

The tasks of this work proposal are the first steps to a deeper understanding of aerosols in laser IFE systems– they focus on utilizing and enhancing an existing aerosol dynamics model developed at the INEEL. This model is to be incorporated into the chamber dynamics code under development at UCSD, a sophisticated tool capable of investigating many of the complicated issues of post-shot chamber physics. An outline of the tasks, along with the schedule for deliverables, is given below. Following that are the budgetary requirements for this work.

Bechtel

In the INEEL M&O contract, Bechtel committed to reinvesting a significant portion of its annual fee in corporate-funded research and development at the laboratory. To meet this commitment, Bechtel and INEEL have created the Corporate-Funded Research and Development (CFRD) Program, which contains a sizable list of projects and likely projects that must be managed to ensure maximum return on Bechtel’s investment. This proposal focuses on the evaluation of technologies that may be developed into CFRD projects for Bechtel National and the necessary program management and communication needs for the CFRD program.

DEPSCoR-AFOSR collaboration - U. Wyoming
(Collaboration on fundamental experiments for flow around synthetic jets)
Conduct a level-of-effort to provide technical support and collaboration in the use of the unique INEEL Matched-Index-of-Refraction (MIR) flow system to accomplish experiments in a University of Wyoming project for DOD/AFOSR entitled "A study of the formation and scaling of a synthetic jet." Efforts may include assistance to U. Wyoming faculty and graduate students, training, fabrication and installation of necessary components, approximate analyses and design, measurements, safety support, review, etc. Tasks to be accomplished will be established by coordination between Prof. D. R. Smith of U. Wyoming and the INEEL Principal Investigator.

The proposed work contributes to the DOE Mission of National Security in its Energy program. It assists in implementing the President's National Energy Plan by conducting fundamental scientific studies leading to energy efficiency improvements in air transportation and, possibly, land transportation and gas turbines for power. The ultimate customer is a National Defense agency, the Air Force Office of Scientific Research, which is interested in improving aircraft performance and efficiency. The experiments will extend the range of applications for which the capabilities of the unique INEEL MIR flow system have been applied to include coupled internal and external flows, a situation of concern for building protection in the National Defense program addressing threats of weapons of mass destruction.

The objective of the proposed investigation is to obtain fundamental measurements of the interaction between a turbulent boundary layer and a unique flow control actuator. Successful accomplishment of this project should advance the state of knowledge of boundary layer interaction with synthetic jets and will lead to improved aerodynamic designs that significantly extend the performance envelope of U. S. aircraft. Completion of the experiments proposed to AFOSR requires the use of the INEEL MIR flow system, the largest such system in the world and, to our knowledge, the only one in the United States with the necessary size.

Technical Assistance Projects

The INEEL Technical Assistance Program provides INEEL technical expertise to address a variety of needs of state and local governments and regional small businesses each year. Requesting organizations can receive up to 40 hours of laboratory personnel time at no cost to them to address technical needs that cannot readily be met by commercially available resources in the region. The program is funded with internal funds. In fiscal year 2001, INEEL completed 17 technical assistance projects.

A brief description of each 2002 technical assistance project is provided below.

INEEL provided ***Plasma Quench Technologies***, a small local business, Gas Chromatograph analysis of 12 samples. The analyses were well received and appreciated. PI: Cathy Rae

We provided support to the ***Exploratorium in San Francisco*** in designing interactive biotech displays in the museum. We also assisted in planning future directions. PI: Debonny Shoaf

We provided to the ***City of Firth***, an assessment of buildings being D&D'd in the city to determine potential hazards of asbestos. Bob Tyng performed the assessment.

We provided remote sensing support to ***Idaho State Historic Preservation Office*** to evaluate a construction area where a grave was found with remains of a native American. There was concern that the grave might be part of a larger cemetery. An INEEL team consisting of Clayton Marler, Debbie Silvas, Gail Heath and Roeloff Versteeg performed the assessment.

AMS, a small business in American Falls, was having manufacturing problems in heat treatment during manufacture of soil and groundwater sampling equipment. They were experiencing warping. They received INEEL help evaluating their materials and process.
PI: Art Watkins

Actor's Repertory Theatre of Idaho purchased a historic building in downtown Idaho Falls. They are planning to convert the building to theatrical and educational purposes but needed and expert to assess the building's structural integrity. PI: Patrick Bragassa

ISU College of Engineering asked for support of Chris Jensen, an INEEL employee and a recent ISU graduate, in Accreditation Reviews and in setting up new engineering experiments. The support was provided and appreciated. PI: Chris Jensen

Eastern Idaho Special Services, a local non-profit organization in an old building downtown, was experiencing people getting ill with headaches from odors in the building. They asked for someone to sample the air to see what the problem was. INEEL's Industrial Hygiene group went to sample the air and evaluate the situation. There were no bad actors in the air, but there were several problems identified: the building's fresh air intake was disconnected; the sewer vents on the roof were plugged with snow; a garage was working on vehicles without proper venting next door; and etc. The custodian was advised to correct the problems and the odor seems to have dissipated. PI: Bob Parker

Helped the ***Rigby/Jefferson County Airport*** with engineering specifications for airport improvement grant applications. PI's: Steve Davies, Kurt Fritz

Helped the ***Teton County Commissioners*** evaluate whether or not they needed to install a groundwater monitor at their county landfill. PI: Jerry Sehlke.

Helped ***TSI Contact Center (a small IF business)*** evaluate their network security risks and abatement options. PI: Elizabeth Faultersack.

Intrepid Engineering Services, a local, small business, engineering consulting company in Idaho Falls had taken samples from a mining project in Bliss, Idaho. They needed the samples evaluated in terms of material composition. PI: Sue Watkins

Provided seismic analysis and guidance on a future location of a ***municipal solid waste landfill along the Bora fault line*** in MacKay. PI's: Ron Rope and Richard Smith

Helped the ***Rexburg office of Alliance Title & Escrow*** (small business) do an ergonomic assessment for an associate experiencing neck and shoulder pain while using the computer. Made recommendations. PI: Vera Bolton

Helped the local business, ***Corporate Express***, when they experienced a strong chemical odor and had no known source. The building was evacuated. We installed monitors and did sampling. Appeared to be HVAC problems. PI: Bob Parker

Helped the ***Bannock County Weed Control Dept*** understand how to use their specific GPS equipment. INEEL was the only other organization they could find that was using this operating system. PI: Ron Rope

Helped the ***City of Salmon*** in their planning of a main street history center in the downtown area. They had grants, and enthusiasm; but an old building next door was a concern. Was it stable; would an earthquake topple it? Recommended a sturdy cover over the history center that would withstand falling bricks. PI: Pat Bragassa.

Helped the ***University of Wyoming*** advance their understanding for the fluid dynamical scaling of a synthetic jet flow control device. It required the capabilities of INEEL's Matched-Index-of Refraction (MIR) facility. PI: Don McEligot

Helped ***Innovative Construction Technologies Corp***, a local small business, understand fiber reinforcement applicability and compatibility with plastics. PI: Eric Peterson.

Helped the ***Teton County Commissioners*** by providing information INEEL had compiled on a Teton Basin modeling effort. This information and guidance given will support a new modeling project. PI: Ron Arnett.

The ***Governor of the State of Wyoming*** requested that an INEEL environmentalist serve on the Water and Waste Advisory Board for the State of Wyoming during FY2002. PI: Lori Cahn

Assisted ***Doug Colonel***, a small business owner inside Grand Teton National Park, in assessing environmental requirements for an Environmental Management Plan and a Risk Management Plan. PI: Lori Cahn

Provided assistance to the ***American Legion Auxiliary*** in Malad, Idaho designing a plan for a Veteran's Memorial Park in town. PI: Stan Palmer

Provided technical consulting to ***Dome Technology***, small IF business, regarding use of concrete domes for nuclear containment. PI: Steve Piet

Provided structural engineering guidance to the ***City of Salmon, ID*** when a heavy rainstorm caused significant damage to a historic rock wall on the riverfront. PI: Patrick Wayne Bragassa

Provided architectural assistance to the ***Bonneville County Museum*** in the design and layout of office space in preparation for grant requests. PI: Dianne Nishioka